

**STETHOCONUS JAPONICUS (HETEROPTERA: MIRIDAE): A
PREDATOR OF STEPHANITIS LACE BUGS NEWLY DISCOVERED
IN THE UNITED STATES, PROMISING IN THE BIOCONTROL OF
AZALEA LACE BUG (HETEROPTERA: TINGIDAE)**

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Abstract.—The first Western Hemisphere record of the predatory Japanese plant bug *Stethoconus japonicus* Schumacher is reported based on specimens collected in four localities in Maryland. Established populations of this potentially useful, adventive, obligate predator of *Stephanitis* lace bugs were discovered preying on the azalea lace bug, *Stephanitis pyrioides* (Scott), also native to Japan. Predatory habits of species in the genus are reviewed, the adult is redescribed and illustrated, and information to help separate *japonicus* from other Nearctic Miridae is provided. The genus *Stethoconus*, previously placed in the tribe Clivinemini of the subfamily Deraeocorinae, is transferred to Hyaliodini also in the Deraeocorinae.

During 1985 while studying the field biology of the azalea lace bug, *Stephanitis pyrioides* (Scott), one of us (KMG) discovered a population of an unrecognized plant bug on an isolated, U.S. grown, potted azalea in Beltsville, Maryland. Initial observations indicated that adults and nymphs were preying on the lace bugs. Eventual study of these specimens revealed that the mirid was *Stethoconus japonicus* Schumacher, known only from Japan.

Herein, we review the literature discussing the predatory habits of species in *Stethoconus* Flor, give the first distribution and host records of *S. japonicus* in North America, redescribe and illustrate the adult, and provide information to help separate this species from all other Nearctic Miridae, including a clarification of the tribal and subfamily placement and its transfer to the tribe Hyaliodini in the subfamily Deraeocorinae.

This report was prepared to alert others studying azalea lace bug of the occurrence of this potentially important predator in the United States.

PREDATORY HABITS IN THE GENUS *STETHOCONUS*

The mirid genus *Stethoconus* contains eight Old World species, of which only two African species are not yet proven exclusive predators of lace bugs or Tingidae (Carayon, 1960). The species now included in *Stethoconus* are: *bimaculatus* (Schouteden), 1946, known from Africa ["Burunga, Luenga, and Mikeno volcano"]; *cyrtopeltis* (Flor), 1860, from northern Europe; *distanti* (Schouteden),

1946, from Africa ["Abimva"]; *frappai* Carayon, 1960, from Madagascar; *japonicus* Schumacher, 1917, from Japan; *praefectus* (Distant), 1909, from India and Sri Lanka; *pyri* (Mella), 1869, from southern Europe and western Transcaucasia; *scutellaris* (Schouteden), 1946, from Africa ["Rutshura"].

Stethoconus pyri (Mella) [most frequently cited as *Stethoconus cyrtopeltis* (Kerzhner, 1970)], one of the better known species, is closely associated with the pear lace bug, *Stephanitis pyri* (Fabricius), found on various fruits, including apple, apricot, peaches, and pears, and other trees such as hawthorn, linden, and mountain ash (Carayon, 1960). Wagner (1970) illustrated the adult dorsal habitus, head, and claws [as *cyrtopeltis*]. Rey (1881) remarked that the predatory nymphs of *Stethoconus pyri* [as *Stethoconus mamillosus* Flor, 1861] closely resembled the appearance, coloration, and movements of *Stephanitis pyri* nymphs to the extent that he declared them "mimics." Gautier (1927) observed that *Stethoconus pyri* [as *cyrtopeltis*] uses its front legs to hold *Stephanitis pyri* and does not abandon its prey until it is completely empty of fluids. He reported also that a single nymph of this mirid could destroy more than 20 lace bugs in a single day. In the USSR, Puchkov and Puchkova (1957) also observed that individuals of *Stethoconus pyri* [as *cyrtopeltis*] use their anterior legs to hold prey against the leaf surface of linden, randomly probe with their rostrum, and feed until the lace bug is drained. They reported that a 3rd instar nymph could destroy 5–10 or more 1st and 2nd instar *pyri* nymphs in 24 hours. Golfari (1937) considered *Stethoconus pyri* [as *cyrtopeltis*] the most important predator attacking *Stephanitis pyri* in central Italy, followed by anthocorids, nabids, and a mymarid egg parasite.

In northern Europe where *Stephanitis pyri* is absent, Schumacher (1917) suggested that *Stephanitis oberti* Kolenati served as the host of *Stethoconus cyrtopeltis*. This information is probably the only correct prey association for *cyrtopeltis*. Kerzhner (1970) illustrated male parameres and provided a key to separate *Stethoconus cyrtopeltis* from *Stethoconus pyri*.

Stethoconus praefectus (Distant) is a major predator of a coconut palm lace bug, *Stephanitis typicus* Distant, in India. Mathen et al. (1967) first noted for *praefectus* [as *Apollodotus praefectus*] "that the swift-moving, milk-white predatory nymphs were available in large numbers . . ." on coconut seedlings and, in the laboratory, they fed on all stages of the coconut lace bug, *Stephanitis typicus*, at the rate of one to seventeen nymphs per predator nymph per day. Mathen and Kurian (1972) studied the life history in more detail and described and illustrated the life stages. In that study, 54 to 74 lace bugs were consumed during nymphal development, and adults consumed an average of slightly more than 5 lace bugs per day, a significant number considering that this bug breeds throughout the year and females potentially produce more than 50 eggs during their life cycle.

Cheng (1967), in studying the ecology of *Stephanitis typicus* on banana in Taiwan, reported that a *Stethoconus* sp. [possibly *praefectus*] could be found throughout the year, except December and January, and that females of this predatory species deposited an average of 34 eggs in 8–10 days. He further noted that a single specimen of this species destroyed about 356 tingids during its life.

Less is known about the African species of *Stethoconus* but at least two are known to feed on tingids. *Stethoconus scutellaris* (Schouteden) from the Zaire (previously Belgian Congo) is said to be an important predator of coffee tingids in the genus *Habrochila* (Carayon, 1960). More recently, Carayon (1960) described

the new species *Stethoconus frappai* from Madagascar, which was found preying on a coffee tingid, *Dulinius unicolor* (Signoret). Decazy (1975), in studying the control of *D. unicolor*, noted that *frappai* afforded some degree of control when lace bug populations were high and recommended special timing of insecticide applications to avoid affecting predator levels.

Stethoconus japonicus Schumacher

No detailed life history data are available for *japonicus*. Nawa (1910) reported that its habits [as *Capsus* sp.] in Japan were similar to those of *cyrtopeltis* and *praefectus* and provided illustrations of the adult (including the antenna, rostrum, legs, wings, and genital capsule) and a figure of a nymph feeding on *Stephanitis ambigua* Horvath [as *Stephanitis pyrioides* (Scott); clarified by Schumacher, 1917]. Esaki (1932) illustrated the adult and noted that this beneficial species also preys on *Stephanitis nashi* Esaki and Takeya. Kerzhner (1970) illustrated the male parameres.

Our observations in Maryland indicate that *japonicus* is a voracious predator of azalea lace bug and, although both species are native to Japan, this report may be their first predator-prey association (Oliver et al., 1985). The literature leaves little doubt that all members of the genus *Stethoconus* are specialized predators of Tingidae; all but the African species appear to prefer lace bugs of the genus *Stephanitis*. Reports of prey consumption for *pyri* and *praefectus* indicate that members of the genus are potentially important biological control agents that could be used in integrated pest management programs. Because *japonicus* is said to have habits similar to those of better known *Stethoconus* species, the presence of large, established populations of this species in the United States could have a significant impact on azalea lace bug control programs. Researchers working with ornamental azaleas should be alert to the presence of this adventive, beneficial species in the United States.

Description of adult (Figs. 1-6).—*Male*: Length 3.58–3.76 mm, width across widest point on hemelytra 1.76–1.84 mm; general coloration yellowish brown with extensive fuscous markings; clothed with rather long, semierect, yellowish pubescence. *Head* (Figs. 1, 2): Length 0.26–0.30 mm, width 0.78–0.80 mm, vertex 0.28–0.30 mm; much wider than long, basal margin distinctly carinate, eyes prominent, not touching anterior margin of pronotum; shiny yellow to yellowish orange, vertex sometimes with an inverted, dark-brown, V-shaped mark extending to bases of antennae, tylus narrowly bordered by dark brown. *Rostrum*: Length 0.96–1.02 mm, extending to middle of prosternum between pro- and mesocoxae; yellowish brown with apex of segment IV fuscous. *Antenna*: Pale yellowish brown, segment I sometimes more yellow to yellowish orange, apical ½ of segment II fuscous; segment I, length 0.30–0.32 mm; II, 1.28–1.34 mm; III, 0.36–0.40 mm; IV, 0.32–0.34 mm. *Pronotum* (Figs. 1-2): Length 0.96–1.00 mm; basal width 1.52–1.56 mm; trapeziform, distinctly convex, evenly and deeply punctate except for shiny depressed calli, area between calli with a somewhat V-shaped carina; areas between punctures on disc appearing calloused, callouses coalescing in some areas to form small bumps or blunt tubercles, collar wide, punctate, about 0.16–0.18 mm long at meson; lateral margins rounded, straight in dorsal aspect, with a distinct, narrow carina on propleura; posterior margin straight through middle with lateral ⅓ angled anteriorly; overall coloration yellowish brown, mesal carina

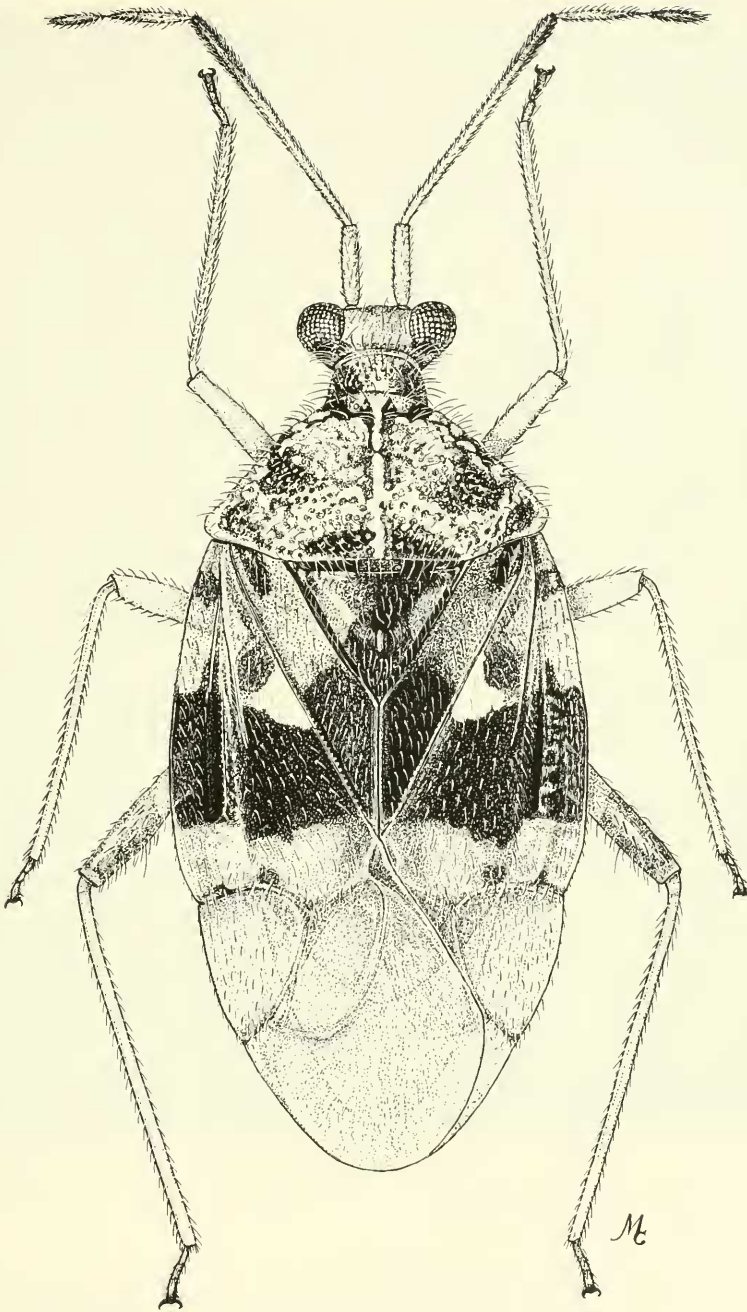
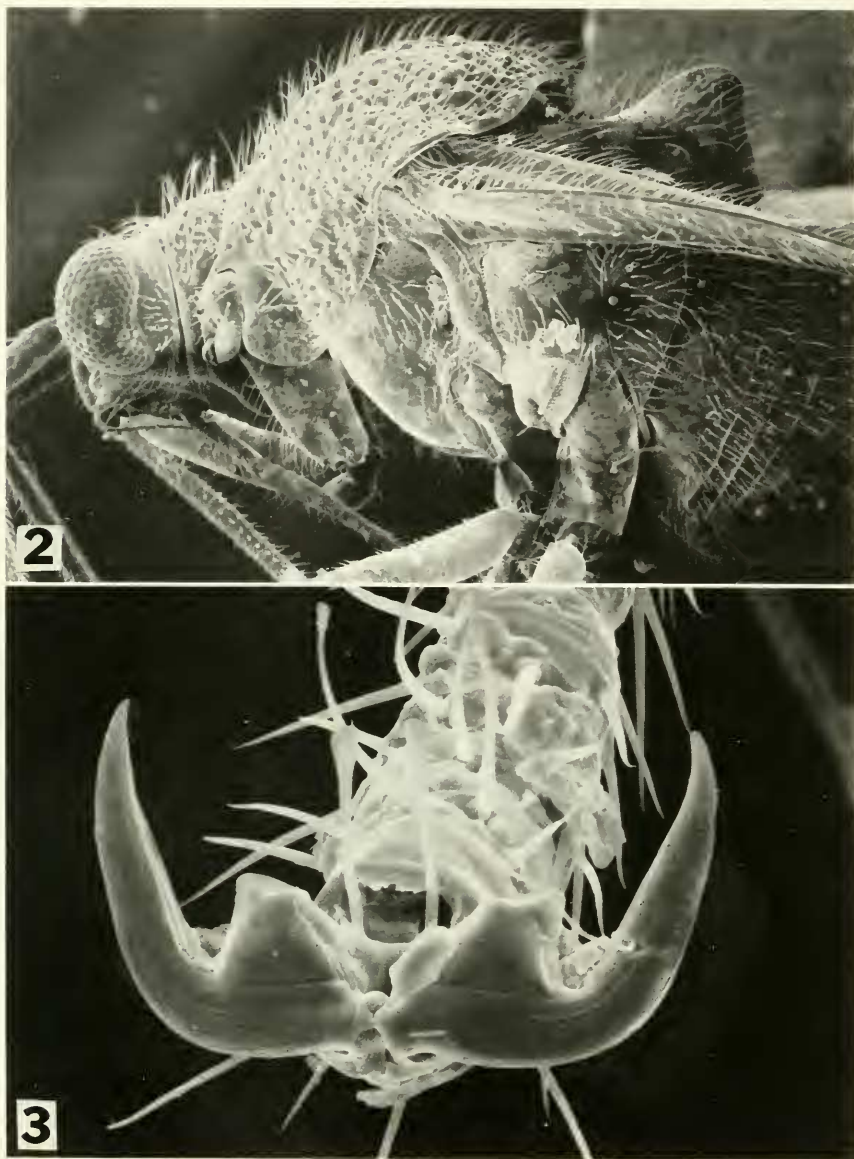


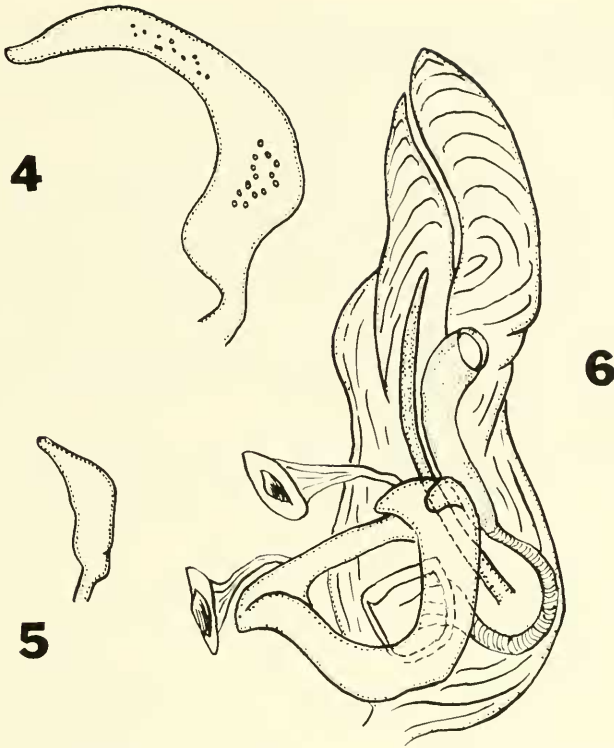
Fig. 1. Adult female habitus of *Stethoconus japonicus*.

and calloused areas between punctures ivory white, two large spots at base of disc on either side of mesal carina, two spots on middle of disc near lateral margins, and area bordering calli dark brown. *Scutellum* (Fig. 2): Shiny fuscous, each side of base with a large yellowish spot; swollen, cone-shaped, nearly pyramidal; apex



Figs. 2, 3. Scanning electron micrographs of *Stethoconus japonicus*. 2, Lateral aspect of head and thorax (48.5 \times). 3, Deeply cleft claw (867 \times).

laterally compressed. *Hemelytra*: Broadly rounded, embolium wide; generally shiny, yellowish brown with a large, wide, dark-brown to fuscous band through middle of embolium, corium, and clavus, a large, irregular, white spot at middle of corium (anterior to fuscous band) adjacent to clavus, also with a dark brown or fuscous spot at base of embolium, clavus, and on anterior side of white spot, cuneus and apical $\frac{1}{4}$ of corium translucent, tinged with pale brown, apex of cuneus sometimes brown. *Ventral surface*: Thorax shiny, fuscous to black, ostiolar evaporative area and a narrow mesopleural sclerite yellowish; abdomen shiny yellow



Figs. 4–6. Male genitalia of *Stehoconus japonicus*. 4, Left paramere. 5, Right paramere. 6, Aedeagus.

to pale yellowish brown, invaded by darker brown along segment margins and ventral area of basal segments. *Legs*: Uniformly pale yellow, metafemur with a wide, fuscous, subapical band and apex yellow to yellowish orange. *Claws*: Deeply cleft (Fig. 3). *Genitalia*: Left paramere (Fig. 4); right paramere (Fig. 5); aedeagus (Fig. 6).

Female: Length 4.08–4.40 mm, width 2.08–2.12 mm. *Head*: Length 0.40–0.42 mm, width 0.76–0.78 mm, vertex 0.30–0.34 mm. *Rostrum*: Length 1.06–1.14 mm. *Antenna*: Segment I, length 0.36–0.38 mm; II, 1.30–1.32 mm; III, 0.40–0.44 mm; IV, 0.28–0.30 mm. *Pronotum*: Length 1.06–1.16 mm, basal width 1.60–1.74 mm.

Very similar to male in coloration and markings, differing in the larger, more robust size and more broadly rounded hemelytra.

Voucher specimens preserved (all specimens in U.S. National Museum of Natural History, Washington, D.C. [USNM]).—Maryland: 4 ♂, 1 ♀ (plus nymphs), Prince Georges Co., USDA Res. Area (BARC-East), 1–2 Aug. 1985, K. M. Gott and J. W. Neal, Jr., taken on Martha Hitchcock azalea, infested with *Stephanitis pyrioides*; 3 ♂, 6 ♀ (plus nymphs), Prince Georges Co., Rt. 1, 2 mi. E of Beltsville, 21 Aug. 1985, T. J. Henry, on ornamental azaleas infested with *S. pyrioides*; 4 ♂, 8 ♀ (plus nymphs), Prince Georges Co., Laurel, Rt. 194, 21 Aug. 1985, T. J. Henry, on ornamental azaleas infested with *S. pyrioides*. Numerous other individuals observed in the field or kept for laboratory study.

Remarks.—The generic identification of our specimens eluded us early in the discovery of *S. japonicus*. The combination of deeply cleft claws (Fig. 3), with only simple hairs between them and without fleshy arolia, the deeply punctate pronotum (Figs. 1–2) with a wide, punctate collar, and the shiny, translucent hemelytra having a wide embolium, placed our genus in the subfamily Deraeocorinae and the tribe Hyaliadini using Carvalho's (1955) key to the world mirid genera or to *Hyaliodes* Reuter using Slater and Baranowski's (1978) key to the North American mirid genera. Only through persistent perusal of the world genera did it become apparent that our specimens belonged to the genus *Stethoconus*, until recently (Kerzhner, 1964, 1970), inexplicably placed in the tribe Dicyphini of the subfamily Phylinae (Carvalho, 1958) or Bryocorinae (Schuh, 1976). Careful study of the claws, pronotum, hemelytra and male genitalia convinced us that *Stethoconus* was misplaced in the Dicyphini and should be transferred to the subfamily Deraeocorinae.

Eventual discovery of Kerzhner's (1964) transfer of *Stethoconus* to the subfamily Deraeocorinae supported our conclusion of improper placement in the Dicyphini. We disagree, however, with Kerzhner's (1964, 1970) placement of the genus in the tribe Clivinemini. Clivinemines are characterized by a trapeziform pronotum, having a narrow, impunctate, ringlike collar, and the calli of *Clivinema* and *Largidea* are represented by two depressed, shiny areas connected by an impressed, shiny line (Knight, 1968). Species of *Stethoconus* have the pronotum narrowed anteriorly into a wide, punctate collar and lack the depressed, shiny areas of the calli.

In addition to the adult characters given above, examination of the nymphs, having a distinct, elongate anal tube characteristic of the tribe Hyaliadini (Akingbohunge, 1974; Wheeler, 1980) and an abdominal scent gland opening similar to that of species in *Hyaliodes* (Akingbohunge et al., 1973), further supports placement in the Hyaliadini. We, therefore, remove *Stethoconus* from Clivinemini and transfer it to the tribe Hyaliadini in the subfamily Deraeocorinae, with the realization that the tribal classification within Deraeocorinae needs attention on a world level.

Stethoconus japonicus, unlike any other mirid known from North America, is distinguished from all other Nearctic genera and species by the deeply punctate, swollen pronotum, wide pronotal collar, cleft claws having simple hairlike parmpodia, the cone-shaped scutellum, and the broadly rounded, shiny, partially translucent hemelytra, with a wide embolium, a large white spot on the middle of the corium, and a large, transverse, dark-brown band through the embolium, corium, and clavus (Fig. 1). As mentioned, it will key to the genus *Hyaliodes* in Slater and Baranowski (1978: 188) if the hemelytra are considered completely transparent and glassy. If this choice is not accepted, that is, if the wings are considered "somewhat glassy," then the second antennal segment must be clavate distally, which it is not. Therefore, couplet 140 in Slater and Baranowski should be modified to read as follows:

- | | | |
|------|--|--------------------|
| 140 | Scutellum greatly swollen, nearly cone-shaped | <i>Stethoconus</i> |
| 140a | Scutellum flattened or only slightly raised | 140' |
| 140' | Front wings almost completely transparent and glassy in appearance | <i>Hyaliodes</i> |

- 140" Front wings subopaque throughout or only partially transparent, if appearance somewhat glassy then antennal segment 2 abruptly clavate distally 141

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